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the pacific intertie

Public utility, Electric systems western states
Federal, state, local, Public utilities
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LOS ANGELES DEPARTMENT OF WATER AND POWER

■ COVER — Pacific Intertie transmission line crossing California desert

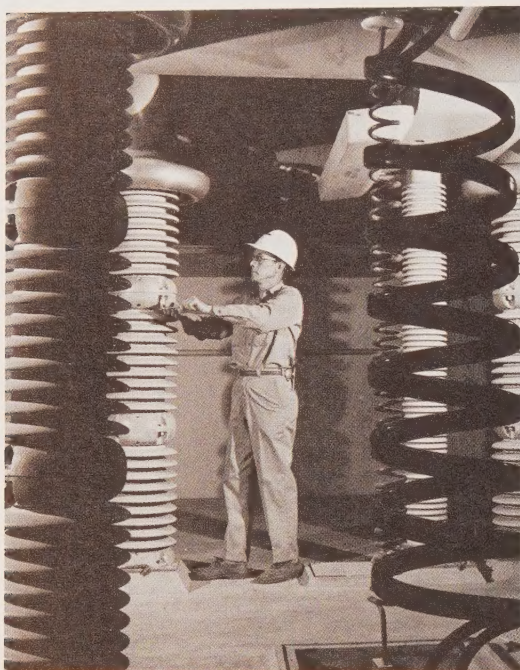
■ BELOW — Workman checks porcelain insulator beneath one of Sylmar Converter Station's 42 big ionic valves

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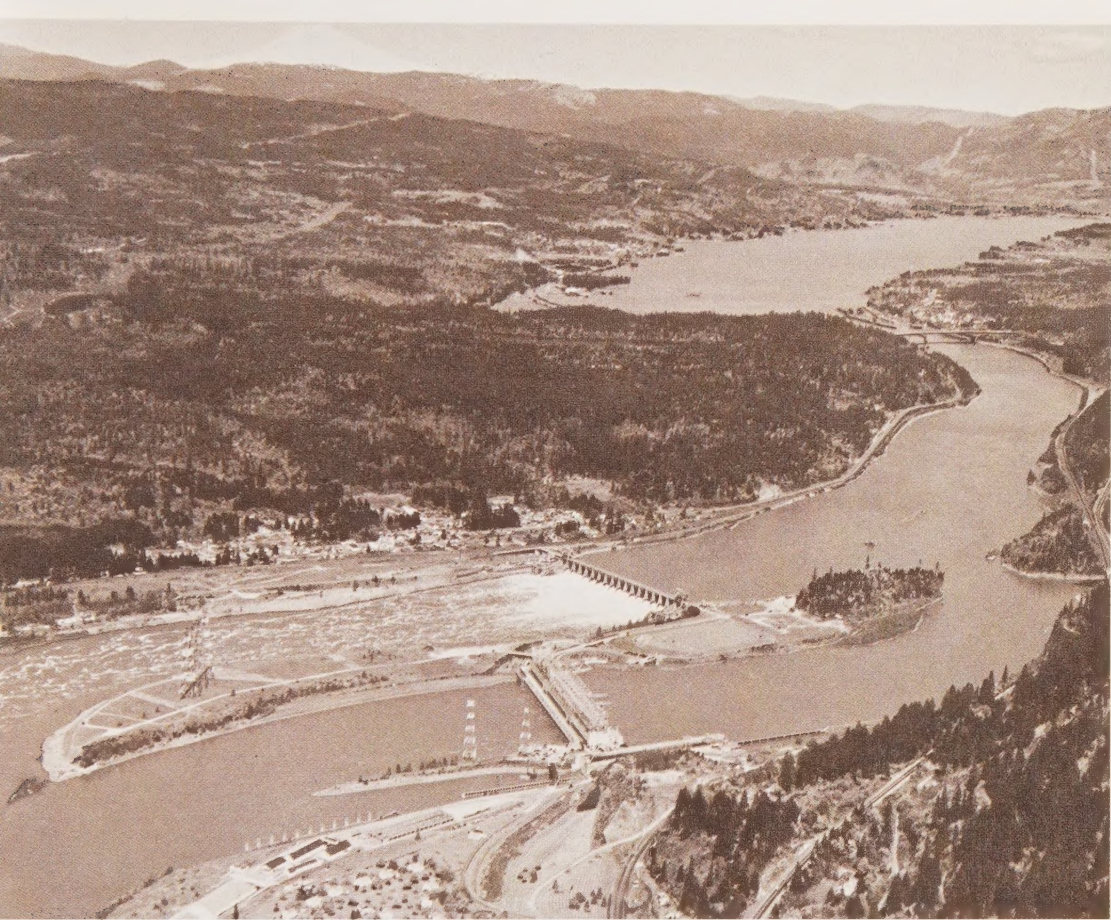
the pacific intertie

LOS ANGELES'
DIRECT CURRENT LINK
WITH THE
PACIFIC NORTHWEST

The Pacific Intertie connecting power-producing regions of the Northwest and the Southwest is a project of outstanding importance to the rapidly growing western regions of the United States.

The Los Angeles Department of Water and Power is a participant in the over-all project through construction, ownership and operation (all shared with other utilities) of one of the major lines of the Intertie network. This is an 800,000 volt direct current transmission line with a rated capacity of 1,440,000 kilowatts connecting Los Angeles with Pacific Northwest power sources.

To assist in developing general understanding of the Intertie program and what it proposes to accomplish, the Department of Water and Power has prepared the information contained in these pages.



■ Columbia River power dams are a source of low cost electricity for Los Angeles over the Intertie. Air view shows Bonneville Dam

Los Angeles' Long-Term Interest in Intertie Possibilities

The Los Angeles Department of Water and Power has joined with four other electric utilities and the federal government in sharing the cost of building, owning and operating the 800,000 volt direct current Pacific Intertie transmission line.

The Department was interested for many years in the possibilities of such an Intertie to deliver low-cost surplus hydroelectric energy from the Pacific Northwest to Los Angeles.

The major proportion of the electric energy needs of the City of Los Angeles is now being supplied by steam electric power plants, and a much smaller proportion by hydroelectric sources. The outlook is that the Department of

Water and Power will continue to depend on steam power generation, either from conventional fossil fuel burning steam power plants or nuclear steam power plants, as its principal source of electricity for the foreseeable future. However, the Department also has continued to recognize the important role that low-cost hydroelectric energy can play in serving the electric generation needs of Los Angeles and the over-all economy of the city.

Efforts by the Northwest to Launch an Intertie Plan

The Pacific Northwest, and particularly the Bonneville Power Administration representing the over-all Columbia River hydroelectric projects, was anxious to find some means of disposing of surplus hydroelectric energy. Columbia River water wasted by by-passing



■ The Intertie's principal transmission lines will provide diversity, reliability

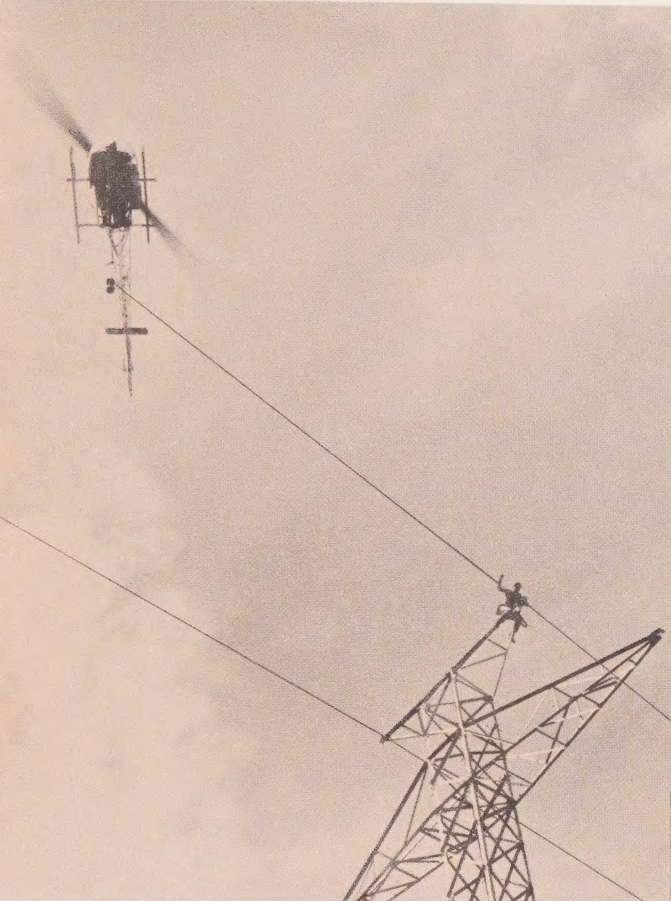
power generators due to lack of sufficient storage capacity in reservoirs, has represented an annual loss of up to \$20 million in potential revenues. Sale of the energy previously going to waste, therefore, is of great importance to the Bonneville Power Administration. The Department of Water and Power has contracted with the Bonneville Power Administration for surplus Northwest energy and for firm peaking capacity under an exchange agreement.

Ratification of a treaty between the United States and Canada providing for the cooperative development of the water resources of the Columbia River Basin also stimulated the progress of the Intertie program. The treaty provides for regulation of the Canadian portion of the Columbia River by the construction of three large dams in Canada which will double the water storage capacity on the

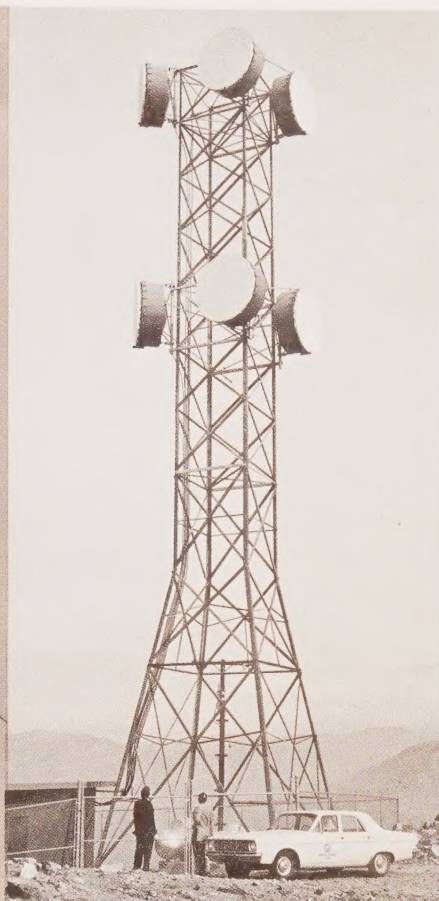
Columbia and increase the annual firm generating capacity at dams on the river in the United States by approximately 2,800,000 kilowatts. This increase is apportioned equally between the United States and Canada.

Because Canada is not ready to utilize its entitlement, that nation has assigned its entitlement for a thirty year period to utility districts, municipalities, cooperatives and private utility companies in the Pacific Northwest region of the United States. These organizations, until they can absorb the assigned entitlement, will re-assign it, at cost, for twelve years to agencies in the Pacific Southwest. The Department of Water and Power has contracted to purchase a substantial amount of this "Canadian entitlement power" for transmission to Los Angeles over the Intertie.

The sale of Canada's power entitlement in



■ Helicopters helped string wire during Intertie construction



■ Intertie microwave communications station

the United States during the thirty year period will supply the revenues needed to amortize the bonds issued in the Northwest to provide the funds to build the Canadian storage facilities.

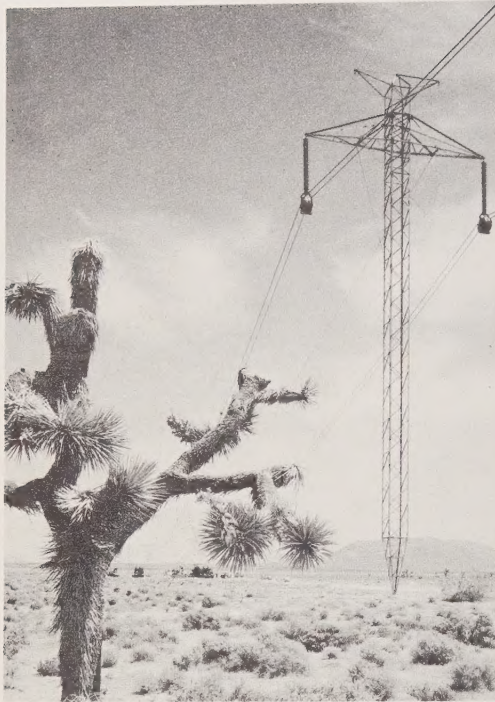
Combination Intertie System Recommended to Congress

On June 24, 1964 the Secretary of the Interior submitted to the Congress the Interior Department's Intertie report and recommendation. Construction of four large transmission lines and related connecting lines by a combination of public and private utilities and the federal government was recommended as a program that would result in the greatest over-all benefit. The four large lines include:

A. *The 800,000 volt d.c. line of DWP and participating utilities* — (described on next page)

B. *The California Power Pool Project* — The California Power Pool, composed of three

California investor-owned utilities, has constructed two 500,000 volt alternating current lines in California connected with transmission lines from Oregon linked to the Bonneville system. Each provides capacity to receive and transmit up to 1,000,000 kw from the point of connection with lines from the Northwest. Agencies of the United States government and Oregon utilities constructed the necessary transmission facilities in Oregon and a portion of Northern California. The federal government has built a 101-mile leg of one of the 500,000 volt a.c. lines from the Oregon border to Round Mountain, California, and a 33-mile connection at 230,000 volts from Round Mountain to Cottonwood station on the Central Valley system. This has provided a direct federal transmission tie between the Bonneville and the Central Valley systems.



■ Cable stringing on the Intertie in Antelope Valley

C. A fourth transmission line to be built by the federal government — This is an 800,000 volt direct current line of 1,440,000 kilowatts capacity to extend from the Dalles in Oregon through Nevada to Hoover Dam. The Arizona Public Service Company is to build a 345,000 volt line from Hoover Dam to Phoenix.

The Department of the Interior estimated that the Intertie project would represent an over-all investment of about \$700 million, the federal portion of which would be about \$300 million. The over-all investment is to be repaid over a period of 50 years.

The Interior Department report also stated that the Intertie project will link Northwest and Southwest in a power interchange system that can make effective use of the seasonal variations in power supply and demand between the two regions. In the summer peak period, when power demand is high in the Southwest

because of air conditioning loads and additional pumping of water for domestic use and irrigation, and large quantities of power are available from the heavy runoff of Northwest rivers, power can be sent south over the Intertie. In the winter, when power demands are lower in the Southwest and the Northwest faces higher power demands while its river runoff is reduced, power can be sent north over the Intertie.

The DWP Portion of the Intertie System

1. This includes a direct current transmission line at 800,000 volts with facilities for conversion to alternating current at Sylmar Station, Los Angeles. (The Sylmar Station will rectify alternating current to direct current when transmitting power to the Northwest.)
2. The line follows the Owens Gorge transmission line right of way, and continues through eastern California and Nevada to the

Castaic Power Project
(Under Construction)

Aqueduct Power Plants

the pacific intertie

800,000 VOLT DIRECT CURRENT
TRANSMISSION LINE

Owens Gorge Transmission Line

So. Cal. Edison Co. Interconnection

Olive Switching Station

Sylmar Converter Station

Sylmar Switching Station

266 Mile Boulder Power
Transmission System

Station J

Rinaldi
Station

Station M

Valley Steam Plant

Station T

Tarzana
Switching Station

Station S

Station E

Glendale-Burbank
Inter-connection

Victorville
Switching Station

Station G

Station A

Pasadena
Inter-connection

Station H

Station P

River
Switching Station

Station F

So. Cal. Edison Co.
Inter-connection

PACIFIC OCEAN

PRINCIPAL
POWER SUPPLY
AND DISTRIBUTION
SYSTEMS

Station K

Station D

Station N

Gramercy
Switching Station

Scattergood
Steam Plant

Station B

Station C

Station Q

Harbor
Steam Plant

Haynes
Steam Plant

LOS ANGELES DEPARTMENT OF WATER AND POWER

Picture map of the 464 square mile City of Los Angeles shows the southernmost portion of the route of the 846 mile long Pacific Intertie transmission line connecting Los Angeles with power sources of the Pacific Northwest. Other Department of Water and Power facilities shown include hydroelectric and steam power generating plants, receiving, switching and converter stations, major in-city transmission lines, and transmission lines from Hoover Dam Power Plant on the Colorado River, and Owens Gorge hydro plants in the High Sierra. Los Angeles is indicated by the lighter area of the map. Darker areas within the City or contiguous to it represent other incorporated cities or unincorporated county territory.

Nevada-Oregon border, a distance of about 581 miles from its Los Angeles terminal.

3. The Bonneville Power Administration's 800,000 volt direct current line from the point of connection with the DWP line at the Nevada-Oregon border to the Celilo Station near the Dalles Dam on the Columbia River covers a distance of 265 miles.

4. The total line, 846 miles long, is the longest distance, highest capacity direct current transmission line in the world.

5. The estimated cost of the portion of the line from Los Angeles to the Nevada-Oregon border, including the cost of the terminal station and conversion facilities at Sylmar, is \$113 million exclusive of land.

6. The estimated cost of the federal government's portion of the line, including the terminal station and conversion facilities at Celilo Station, is about \$70 million.

7. The line delivers 1,300,000 kilowatts of power at either end.

A. The DWP will use 520,000 kw of the line's capacity.

B. The municipal power systems of Pasadena, Burbank and Glendale will use 130,000 kw of capacity.

C. Southern California Edison Company will use 650,000 kw of capacity.

The Southern California Edison Company is participating in the ownership with the DWP, and will pay one-half of the construction cost as well as one-half of the annual operation

and maintenance cost of the line and terminal facilities, and utilize one-half of the transmission capacity. The municipal power systems of Burbank, Glendale and Pasadena have made similar financial arrangements for the transmission capacities used by them.

An important part of the project is the Pacific Intertie microwave system which provides communication between operating personnel and between control computers located in the Sylmar and Celilo Converter terminals at the south and north ends of the DC line. To control power transmission on the line, control computers must precisely coordinate the timing of the converter valves at both the rectifying and inverting terminals.

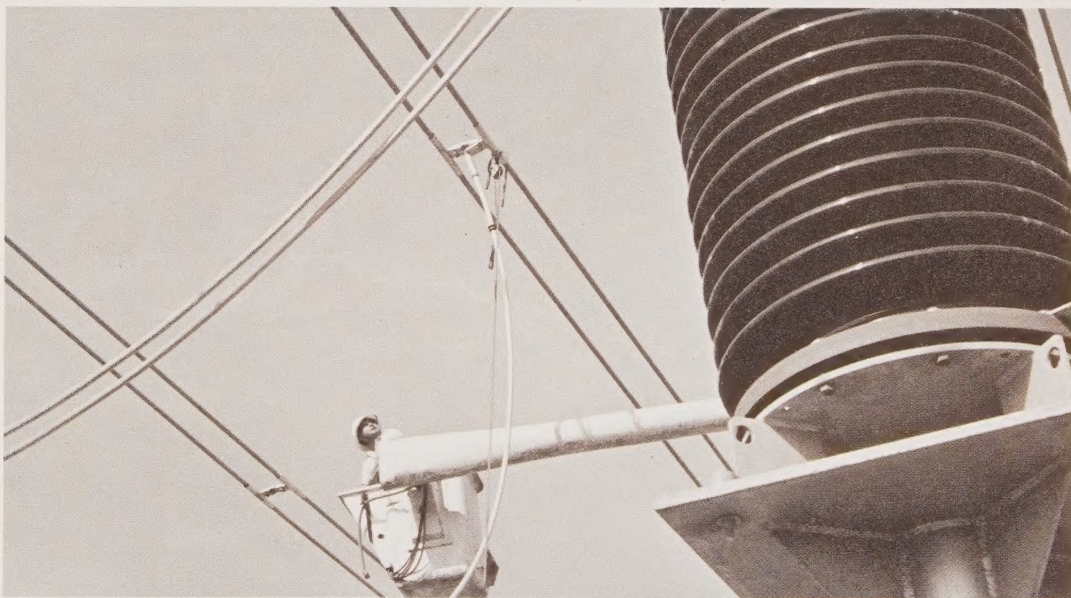
The microwave system includes three terminals and 16 repeater stations between Los Angeles and the Oregon-Nevada border where the system connects to the microwave system built by the Bonneville Power Administration which includes another seven repeater stations.

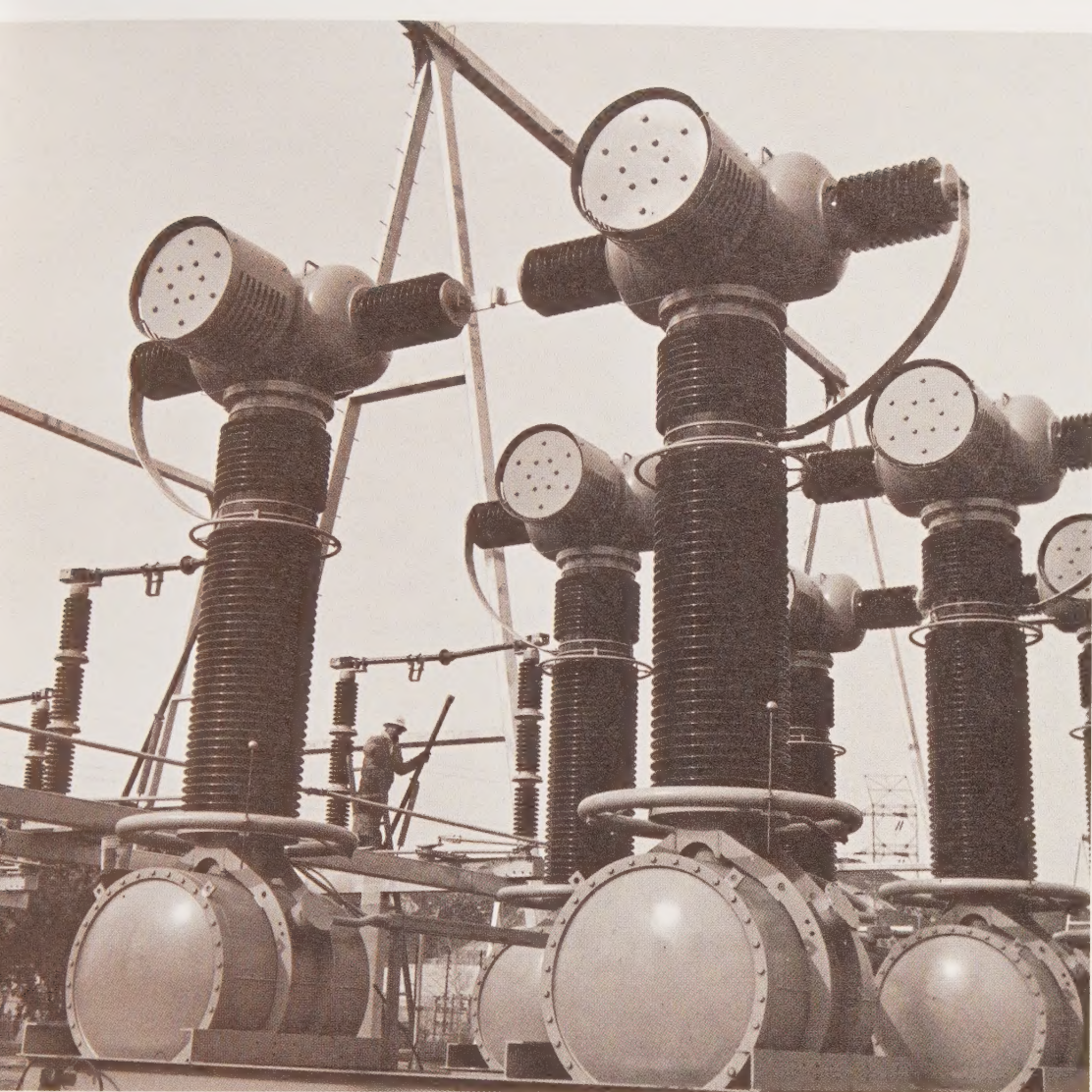
Use of Intertie Capacity by Department of Water and Power

The DWP has three principal uses for its capacity in the Intertie:

1. *For the transmission of DWP's share of Canadian Entitlement power* — An Assignment Agreement between 41 electric utilities in the Pacific Northwest and the Department provides that the Department will receive approximately 20 per cent of Canada's entitlement to the increased generating capacity at

■ Sixteen-foot-high insulator at Sylmar Terminal Station dwarfs workman





■ Large circuit breakers for Intertie at Sylmar terminal

plants on the Columbia River resulting from the new dams being built in Canada. Under the terms of the Agreement, which extends until 1980, the Northwest utilities, on five years notice, can withdraw a part of this assigned firm power.

2. *For firm Exchange Peaking Capacity from the Bonneville Power Administration System* — Under an Exchange Agreement between BPA and DWP, Exchange Peaking Capacity will be made available to DWP in an amount equal to the difference between the amount of Canadian power available under No. 1 (above) and 520,000 kilowatts. This is called

Exchange Peaking Capacity because, at the request of BPA, the Department must deliver to BPA at the Oregon-Nevada border 2,500 kilowatt hours of off-peak energy (called Exchange Energy) for each kilowatt of capacity made available by BPA. If the Exchange Energy is not requested by BPA, DWP will pay BPA three mills per kilowatt hour in lieu of returning such energy.

3. *For the transmission of surplus energy from the Pacific Northwest* — Under a Sales Contract which has been executed between DWP and BPA, the Department will purchase as much surplus energy as it can economi-



cally use, the amount varying according to the DWP's loads and resources. When available, this surplus energy will be used with the Exchange Peaking Capacity to supply Department loads. If surplus energy is not available from BPA, the energy that is used will be returned off-peak.

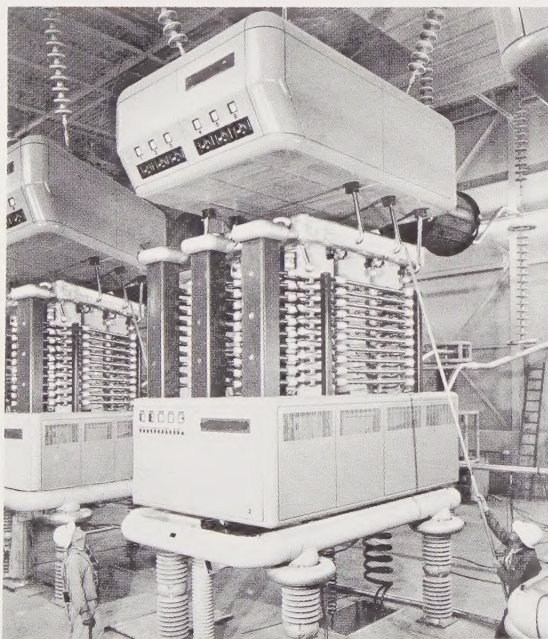
Through these three types of arrangements, Pacific Northwest capacity and energy are made available for delivery to DWP over the 800,000-volt d.c. transmission line to assist in supplying DWP load requirements. The Department's participation in the Intertie Project is made feasible principally through the provisions of the Exchange Agreement with Bonneville. Other types of capacity and energy from the Northwest may be available from time to time and will add to the value to the DWP of the Intertie Project.

Los Angeles' Goal: Low Cost Hydro Energy

Through its participation and its role in helping to guide the Intertie program to its present status, the Department of Water and Power has followed a steadfast policy to take advantage of the opportunity afforded by the Intertie to obtain low cost surplus hydroelectric energy from the Northwest for the benefit of electric users in Los Angeles. This system will offer the greatest over-all advantages of efficiency, reliability and low cost for the transmission of electricity to Los Angeles from the Northwest. The diversity achieved through the several lines included in the over-all Intertie Project will result in the greatest benefits to all concerned, including both the publicly-owned and investor-owned agencies participating in the Intertie program.



■ Helping serve Los Angeles' multiplying electric needs will be 520,000 kilowatts of power from the Pacific Intertie



■ Mercury arc converter valves are designed to change direct current to alternating current, or vice versa, at Sylmar Station, Los Angeles terminal of the Pacific Intertie. At Sylmar there are 42 of the huge valves in a building as large as a football field



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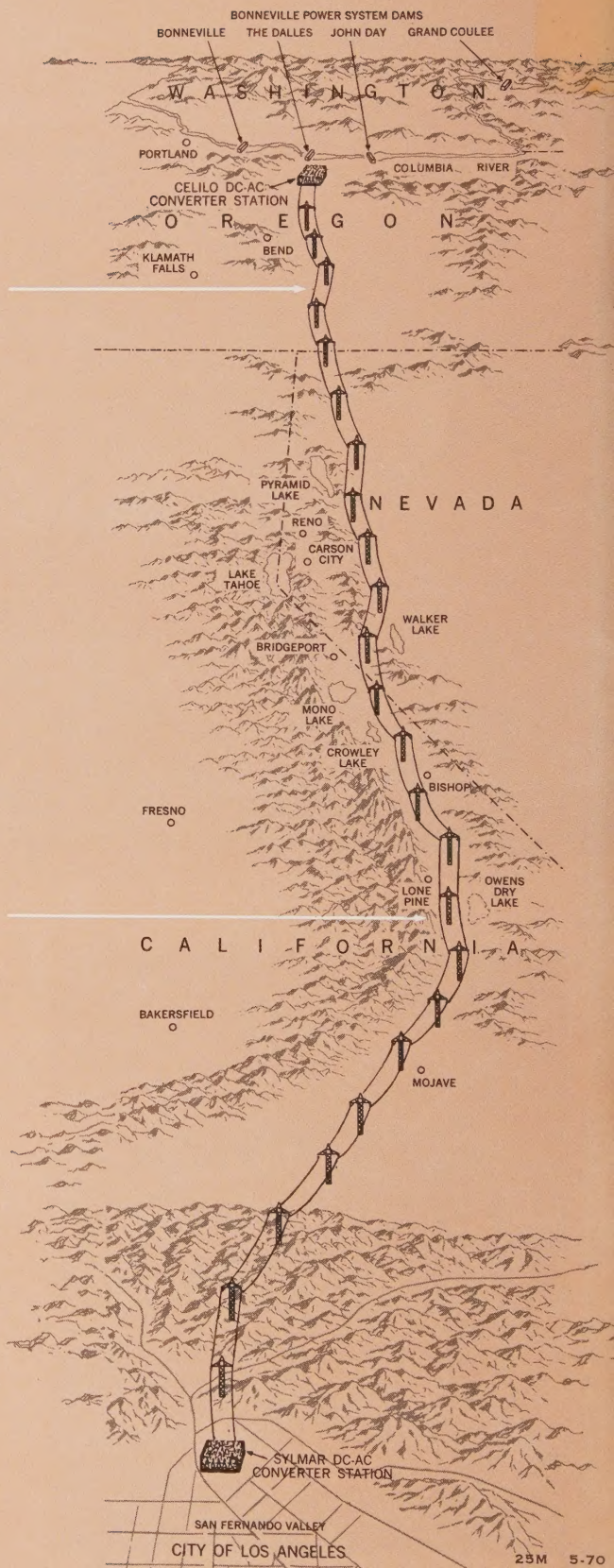
Portion of direct current
line built by
Bonneville Power
Administration,
south to the
Oregon-Nevada border

the pacific intertie

direct current
transmission line
connecting Los Angeles
with power sources in the
Pacific Northwest

Portion of direct current
line built by
the Department
of Water and Power,
Oregon-Nevada border
to Los Angeles

Your
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